

SEQUENCE LISTING

<110> National Institutes of Health

5 Qasba, Pradman

Boeggeman, Elizabeth

Ramakrishnan, Boopathy

<120> Catalytic Domains Of Beta(1,4)-Galactosyltransferase I Having

10 Altered Metal Ion Specificity

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<160> 13

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20<212> PRT

<213> Homo sapiens

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Cys Arg Met Ile Arg His

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Tyr Val Gln Tyr Phe Gly Gly

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<212> PRT

<213> Homo sapiens

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<400> 4

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Ala Ser Leu Gln Arg Ala Cys Arg Leu Leu Val Ala Val Cys Ala Leu

10 20 25 30

His Leu Gly Val Thr Leu Val Tyr Tyr Leu Ala Gly Arg Asp Leu Ser

35 40 45

Arg Leu Pro Gln Leu Val Gly Val Ser Thr Pro Leu Gln Gly Gly Ser

50 55 60

15Asn Ser Ala Ala Ala Ile Gly Gln Ser Ser Gly Asp Leu Arg Thr Gly

65 70 75 80

Gly Ala Arg Pro Pro Pro Pro Leu Gly Ala Ser Ser Gln Pro Arg Pro

85 90 95

Gly Gly Asp Ser Ser Pro Val Asp Ser Gly Pro Gly Pro Ala Ser

20 100 105 110

Asn Leu Thr Ser Val Pro Val Pro His Thr Thr Ala Leu Ser Leu Pro

115 120 125

Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro Met Leu Ile Glu

130 135 140

25Phe Asn Met Pro Val Asp Leu Glu Leu Val Ala Lys Gln Asn Pro Asn

145 150 155 160

Val Lys Met Gly Gly Arg Tyr Ala Pro Arg Asp Cys Val Ser Pro His

165 170 175

Lys Val Ala Ile Ile Ile Pro Phe Arg Asn Arg Gln Glu His Leu Lys

30 180 185 190

Tyr Trp Leu Tyr Tyr Leu His Pro Val Leu Gln Arg Gln Gln Leu Asp

195 200 205

Tyr Gly Ile Tyr Val Ile Asn Gln Ala Gly Asp Thr Ile Phe Asn Arg

210 215 220

35Ala Lys Leu Leu Asn Val Gly Phe Gln Glu Ala Leu Lys Asp Tyr Asp

225 230 235 240

Tyr Thr Cys Phe Val Phe Ser Asp Val Asp Leu Ile Pro Met Asn Asp

245 250 255

His Asn Ala Tyr Arg Cys Phe Ser Gln Pro Arg His Ile Ser Val Ala

40 260 265 270

Met Asp Lys Phe Gly Phe Ser Leu Pro Tyr Val Gln Tyr Phe Gly Gly

275 280 285

Val Ser Ala Ser Ser Lys Gln Gln Phe Leu Thr Ile Asn Gly Phe Pro
290 295 300
Asn Asn Tyr Trp Gly Trp Gly Gly Glu Asp Asp Asp Ile Phe Asn Arg
305 310 315 320
5Leu Val Phe Arg Gly Met Ser Ile Ser Arg Pro Asn Ala Val Val Gly
325 330 335
Thr Cys Arg Met Ile Arg His Ser Arg Asp Lys Lys Asn Glu Pro Asn
340 345 350
Pro Gln Arg Phe Asp Arg Ile Ala His Thr Lys Glu Thr Met Leu Ser
10 355 360 365
Asp Gly Leu Asn Ser Leu Thr Tyr Gln Val Leu Asp Val Gln Arg Tyr
370 375 380
Pro Leu Tyr Thr Gln Ile Thr Val Asp Ile Gly Thr Pro Ser
385 390 395

15
<210> 5
<211> 399
<212> PRT
<213> Mus musculus

20
<400> 5
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Ala Thr Leu Gln Arg Ala Cys Arg Leu Leu Val Ala Val Cys Ala Leu
25 20 25 30
His Leu Gly Val Thr Leu Val Tyr Tyr Leu Ser Gly Arg Asp Leu Ser
35 40 45
Arg Leu Pro Gln Leu Val Gly Val Ser Ser Thr Leu Gln Gly Gly Thr
50 55 60
30Asn Gly Ala Ala Ala Ser Lys Gln Pro Pro Gly Glu Gln Arg Pro Arg
65 70 75 80
Gly Ala Arg Pro Pro Pro Leu Gly Val Ser Pro Lys Pro Arg Pro
85 90 95
Gly Leu Asp Ser Ser Pro Gly Ala Ala Ser Gly Pro Gly Leu Lys Ser
35 100 105 110
Asn Leu Ser Ser Leu Pro Val Pro Thr Thr Gly Leu Leu Ser Leu
115 120 125
Pro Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro Met Leu Ile
130 135 140
40Asp Phe Asn Ile Ala Val Asp Leu Glu Leu Leu Ala Lys Lys Asn Pro
145 150 155 160

Glu Ile Lys Thr Gly Gly Arg Tyr Ser Pro Lys Asp Cys Val Ser Pro
 165 170 175
 His Lys Val Ala Ile Ile Ile Pro Phe Arg Asn Arg Gln Glu His Leu
 180 185 190
 5Lys Tyr Trp Leu Tyr Tyr Leu His Pro Ile Leu Gln Arg Gln Gln Leu
 195 200 205
 Asp Tyr Gly Ile Tyr Val Ile Asn Gln Ala Gly Asp Thr Met Phe Asn
 210 215 220
 Arg Ala Lys Leu Leu Asn Ile Gly Phe Gln Glu Ala Leu Lys Asp Tyr
 10225 230 235 240
 Asp Tyr Asn Cys Phe Val Phe Ser Asp Val Asp Leu Ile Pro Met Asp
 245 250 255
 Asp Arg Asn Ala Tyr Arg Cys Phe Ser Gln Pro Arg His Ile Ser Val
 260 265 270
 15Ala Met Asp Lys Phe Gly Phe Ser Leu Pro Tyr Val Gln Tyr Phe Gly
 275 280 285
 Gly Val Ser Ala Leu Ser Lys Gln Gln Phe Leu Ala Ile Asn Gly Phe
 290 295 300
 Pro Asn Asn Tyr Trp Gly Trp Gly Glu Asp Asp Asp Ile Phe Asn
 20305 310 315 320
 Arg Leu Val His Lys Gly Met Ser Ile Ser Arg Pro Asn Ala Val Val
 325 330 335
 Gly Arg Cys Arg Met Ile Arg His Ser Arg Asp Lys Lys Asn Glu Pro
 340 345 350
 25Asn Pro Gln Arg Phe Asp Arg Ile Ala His Thr Lys Glu Thr Met Arg
 355 360 365
 Phe Asp Gly Leu Asn Ser Leu Thr Tyr Lys Val Leu Asp Val Gln Arg
 370 375 380
 Tyr Pro Leu Tyr Thr Gln Ile Thr Val Asp Ile Gly Thr Pro Arg
 30385 390 395

<210> 6

<211> 402

<212> PRT

35<213> Bos taurus

<400> 6

Met Lys Phe Arg Glu Pro Leu Leu Gly Gly Ser Ala Ala Met Pro Gly
 1 5 10 15
 40Ala Ser Leu Gln Arg Ala Cys Arg Leu Leu Val Ala Val Cys Ala Leu
 20 25 30

His Leu Gly Val Thr Leu Val Tyr Tyr Leu Ala Gly Arg Asp Leu Arg
35 40 45
Arg Leu Pro Gln Leu Val Gly Val His Pro Pro Leu Gln Gly Ser Ser
50 55 60
His Gly Ala Ala Ala Ile Gly Gln Pro Ser Gly Glu Leu Arg Leu Arg
65 70 75 80
Gly Val Ala Pro Pro Pro Leu Gln Asn Ser Ser Lys Pro Arg Ser
85 90 95
Arg Ala Pro Ser Asn Leu Asp Ala Tyr Ser His Pro Gly Pro Gly Pro
10 100 105 110
Gly Pro Gly Ser Asn Leu Thr Ser Ala Pro Val Pro Ser Thr Thr Thr
115 120 125
Arg Ser Leu Thr Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro
130 135 140
15Met Leu Ile Glu Phe Asn Ile Pro Val Asp Leu Lys Leu Ile Glu Gln
145 150 155 160
Gln Asn Pro Lys Val Lys Leu Gly Gly Arg Tyr Thr Pro Met Asp Cys
165 170 175
Ile Ser Pro His Lys Val Ala Ile Ile Ile Leu Phe Arg Asn Arg Gln
20 180 185 190
Glu His Leu Lys Tyr Trp Leu Tyr Tyr Leu His Pro Met Val Gln Arg
195 200 205
Gln Gln Leu Asp Tyr Gly Ile Tyr Val Ile Asn Gln Ala Gly Glu Ser
210 215 220
25Met Phe Asn Arg Ala Lys Leu Leu Asn Val Gly Phe Lys Glu Ala Leu
225 230 235 240
Lys Asp Tyr Asp Tyr Asn Cys Phe Val Phe Ser Asp Val Asp Leu Ile
245 250 255
Pro Met Asn Asp His Asn Thr Tyr Arg Cys Phe Ser Gln Pro Arg His
30 260 265 270
Ile Ser Val Ala Met Asp Lys Phe Gly Phe Ser Leu Pro Tyr Val Gln
275 280 285
Tyr Phe Gly Gly Val Ser Ala Leu Ser Lys Gln Gln Phe Leu Ser Ile
290 295 300
35Asn Gly Phe Pro Asn Asn Tyr Trp Gly Trp Gly Gly Glu Asp Asp
305 310 315 320
Ile Tyr Asn Arg Leu Ala Phe Arg Gly Met Ser Val Ser Arg Pro Asn
325 330 335
Ala Val Ile Gly Lys Cys Arg Met Ile Arg His Ser Arg Asp Lys Lys
40 340 345 350
Asn Glu Pro Asn Pro Gln Arg Phe Asp Arg Ile Ala His Thr Lys Glu
355 360 365

Thr Met Leu Ser Asp Gly Leu Asn Ser Leu Thr Tyr Met Val Leu Glu
370 375 380
Val Gln Arg Tyr Pro Leu Tyr Thr Lys Ile Thr Val Asp Ile Gly Thr
385 390 395 400
5Pro Ser

<210> 7
<211> 113
10<212> PRT
<213> Homo sapiens

<400> 7
Arg Asp Leu Ser Arg Leu Pro Gln Leu Val Gly Val Ser Thr Pro Leu
15 1 5 10 15
Gln Gly Gly Ser Asn Ser Ala Ala Ala Ile Gly Gln Ser Ser Gly Asp
20 25 30
Leu Arg Thr Gly Gly Ala Arg Pro Pro Pro Pro Leu Gly Ala Ser Ser
35 40 45
20Gln Pro Arg Pro Gly Gly Asp Ser Ser Pro Val Val Asp Ser Gly Pro
50 55 60
Gly Pro Ala Ser Asn Leu Thr Ser Val Pro Val Pro His Thr Thr Ala
65 70 75 80
Leu Ser Leu Pro Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro
25 85 90 95
Met Leu Ile Glu Phe Asn Met Pro Val Asp Leu Glu Leu Val Ala Lys
100 105 110
Gln

30
<210> 8
<211> 85
<212> PRT
<213> Bos taurus
35
<400> 8
Arg Asp Leu Arg Arg Leu Pro Gln Leu Val Gly Val His Pro Pro Leu
1 5 10 15
Gln Gly Ser Ser His Gly Ala Ala Ala Ile Gly Gln Pro Ser Gly Glu
40 20 25 30
Leu Arg Leu Arg Gly Val Ala Pro Pro Pro Pro Leu Gln Asn Ser Ser
35 40 45

Lys Pro Arg Ser Arg Ala Pro Ser Asn Leu Asp Ala Tyr Ser His Pro
50 55 60
Gly Pro Gly Pro Gly Pro Gly Ser Asn Leu Thr Ser Ala Pro Val Pro
65 70 75 80
55Ser Thr Thr Thr Arg
85

<210> 9

<211> 273

10<212> PRT

<213> Homo sapiens

<400> 9

Ser Leu Pro Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro Met
15 1 5 10 15
Leu Ile Glu Phe Asn Met Pro Val Asp Leu Glu Leu Val Ala Lys Gln
20 25 30
Asn Pro Asn Val Lys Met Gly Gly Arg Tyr Ala Pro Arg Asp Cys Val
35 40 45
20Ser Pro His Lys Val Ala Ile Ile Ile Pro Phe Arg Asn Arg Gln Glu
50 55 60
His Leu Lys Tyr Trp Leu Tyr Tyr Leu His Pro Val Leu Gln Arg Gln
65 70 75 80
Gln Leu Asp Tyr Gly Ile Tyr Val Ile Asn Gln Ala Gly Asp Thr Ile
25 85 90 95
Phe Asn Arg Ala Lys Leu Leu Asn Val Gly Phe Gln Glu Ala Leu Lys
100 105 110
Asp Tyr Asp Tyr Thr Cys Phe Val Phe Ser Asp Val Asp Leu Ile Pro
115 120 125
30Met Asn Asp His Asn Ala Tyr Arg Cys Phe Ser Gln Pro Arg His Ile
130 135 140
Ser Val Ala Met Asp Lys Phe Gly Phe Ser Leu Pro Tyr Val Gln Tyr
145 150 155 160
Phe Gly Gly Val Ser Ala Ser Ser Lys Gln Gln Phe Leu Thr Ile Asn
35 165 170 175
Gly Phe Pro Asn Asn Tyr Trp Gly Trp Gly Gly Glu Asp Asp Asp Ile
180 185 190
Phe Asn Arg Leu Val Phe Arg Gly Met Ser Ile Ser Arg Pro Asn Ala
195 200 205
40Val Val Gly Thr Cys Arg Met Ile Arg His Ser Arg Asp Lys Lys Asn
210 215 220

Glu Pro Asn Pro Gln Arg Phe Asp Arg Ile Ala His Thr Lys Glu Thr
225 230 235 240
Met Leu Ser Asp Gly Leu Asn Ser Leu Thr Tyr Gln Val Leu Asp Val
245 250 255
5Gln Arg Tyr Pro Leu Tyr Thr Gln Ile Thr Val Asp Ile Gly Thr Pro
260 265 270
Ser

10<210> 10
<211> 273
<212> PRT
<213> Bos taurus

15<400> 10
Ser Leu Thr Ala Cys Pro Glu Glu Ser Pro Leu Leu Val Gly Pro Met
1 5 10 15
Leu Ile Glu Phe Asn Ile Pro Val Asp Leu Lys Leu Ile Glu Gln Gln
20 25 30
20Asn Pro Lys Val Lys Leu Gly Gly Arg Tyr Thr Pro Met Asp Cys Ile
35 40 45
Ser Pro His Lys Val Ala Ile Ile Ile Leu Phe Arg Asn Arg Gln Glu
50 55 60
His Leu Lys Tyr Trp Leu Tyr Tyr Leu His Pro Met Val Gln Arg Gln
2565 70 75 80
Gln Leu Asp Tyr Gly Ile Tyr Val Ile Asn Gln Ala Gly Glu Ser Met
85 90 95
Phe Asn Arg Ala Lys Leu Leu Asn Val Gly Phe Lys Glu Ala Leu Lys
100 105 110
30Asp Tyr Asp Tyr Asn Cys Phe Val Phe Ser Asp Val Asp Leu Ile Pro
115 120 125
Met Asn Asp His Asn Thr Tyr Arg Cys Phe Ser Gln Pro Arg His Ile
130 135 140
Ser Val Ala Met Asp Lys Phe Gly Phe Ser Leu Pro Tyr Val Gln Tyr
35145 150 155 160
Phe Gly Gly Val Ser Ala Leu Ser Lys Gln Gln Phe Leu Ser Ile Asn
165 170 175
Gly Phe Pro Asn Asn Tyr Trp Gly Trp Gly Gly Glu Asp Asp Asp Ile
180 185 190
40Tyr Asn Arg Leu Ala Phe Arg Gly Met Ser Val Ser Arg Pro Asn Ala
195 200 205

Val Ile Gly Lys Cys Arg Met Ile Arg His Ser Arg Asp Lys Lys Asn
210 215 220
Glu Pro Asn Pro Gln Arg Phe Asp Arg Ile Ala His Thr Lys Glu Thr
225 230 235 240
SMet Leu Ser Asp Gly Leu Asn Ser Leu Thr Tyr Met Val Leu Glu Val
245 250 255
Gln Arg Tyr Pro Leu Tyr Thr Lys Ile Thr Val Asp Ile Gly Thr Pro
260 265 270
Ser

10

<210> 11
<211> 1197
<212> PRT
15<213> Homo sapiens

<400> 11
Ala Thr Gly Ala Gly Gly Cys Thr Thr Cys Gly Gly Ala Gly Cys
1 5 10 15
20Cys Gly Cys Thr Cys Cys Thr Gly Ala Gly Cys Cys Gly Ala Gly
20 25 30
Cys Gly Cys Cys Gly Cys Ala Thr Gly Cys Cys Ala Gly Gly Cys
35 40 45
Gly Cys Gly Thr Cys Cys Thr Ala Cys Ala Gly Cys Gly Gly
25 50 55 60
Cys Cys Thr Gly Cys Cys Gly Cys Cys Thr Gly Cys Thr Cys Gly Thr
65 70 75 80
Gly Gly Cys Cys Gly Thr Cys Thr Gly Cys Gly Cys Thr Cys Thr Gly
85 90 95
30Cys Ala Cys Cys Thr Thr Gly Cys Gly Thr Cys Ala Cys Cys Cys
100 105 110
Thr Cys Gly Thr Thr Ala Cys Thr Ala Cys Cys Thr Gly Gly Cys
115 120 125
Thr Gly Gly Cys Cys Gly Cys Gly Ala Cys Cys Thr Gly Ala Gly Cys
35 130 135 140
Cys Gly Cys Cys Thr Gly Cys Cys Cys Ala Ala Cys Thr Gly Gly
145 150 155 160
Thr Cys Gly Gly Ala Gly Thr Cys Thr Cys Cys Ala Cys Ala Cys Cys
165 170 175
40Gly Cys Thr Gly Cys Ala Gly Gly Cys Gly Gly Gly Thr Cys Gly
180 185 190

Ala Ala Cys Ala Gly Thr Gly Cys Cys Gly Cys Cys Gly Cys Ala
195 200 205
Thr Cys Gly Gly Cys Ala Gly Thr Cys Cys Thr Cys Cys Gly Gly
210 215 220
5Gly Gly Ala Cys Cys Thr Cys Cys Gly Ala Cys Cys Gly Gly Ala
225 230 235 240
Gly Gly Gly Cys Cys Gly Gly Cys Cys Gly Cys Cys Gly Cys
245 250 255
Cys Thr Cys Cys Thr Cys Thr Ala Gly Gly Cys Gly Cys Cys Thr Cys
10 260 265 270
Cys Thr Cys Cys Ala Gly Cys Cys Gly Cys Cys Cys Gly
275 280 285
Gly Gly Thr Gly Gly Cys Gly Ala Cys Thr Cys Cys Ala Gly Cys Cys
290 295 300
15Cys Ala Gly Thr Cys Gly Thr Gly Ala Thr Thr Cys Thr Gly Gly
305 310 315 320
Cys Cys Cys Thr Gly Gly Cys Cys Cys Gly Cys Thr Ala Gly Cys
325 330 335
Ala Ala Cys Thr Thr Gly Ala Cys Cys Thr Cys Gly Gly Thr Cys Cys
20 340 345 350
Cys Ala Gly Thr Gly Cys Cys Cys Ala Cys Ala Cys Cys Ala Cys
355 360 365
Cys Gly Cys Ala Cys Thr Gly Thr Cys Gly Cys Thr Gly Cys Cys Cys
370 375 380
25Gly Cys Cys Thr Gly Cys Cys Cys Thr Gly Ala Gly Gly Ala Thr
385 390 395 400
Cys Cys Cys Cys Gly Cys Thr Gly Cys Thr Thr Gly Thr Gly Gly
405 410 415
Cys Cys Cys Cys Ala Thr Gly Cys Thr Gly Ala Thr Thr Gly Ala Gly
30 420 425 430
Thr Thr Thr Ala Ala Cys Ala Thr Gly Cys Cys Thr Gly Thr Gly Gly
435 440 445
Ala Cys Cys Thr Gly Gly Ala Gly Cys Thr Cys Gly Thr Gly Gly Cys
450 455 460
35Ala Ala Ala Gly Cys Ala Gly Ala Ala Cys Cys Cys Ala Ala Ala Thr
465 470 475 480
Gly Thr Gly Ala Ala Gly Ala Thr Gly Gly Gly Cys Gly Gly Cys Cys
485 490 495
Gly Cys Thr Ala Thr Gly Cys Cys Cys Cys Ala Gly Gly Ala
40 500 505 510
Cys Thr Gly Cys Gly Thr Cys Thr Cys Cys Cys Thr Cys Ala Cys
515 520 525

Ala Ala Gly Gly Thr Gly Gly Cys Cys Ala Thr Cys Ala Thr Cys Ala
530 535 540
Thr Thr Cys Cys Ala Thr Thr Cys Cys Gly Cys Ala Ala Cys Cys Gly
545 550 555 560
565 570 575
5Gly Cys Ala Gly Gly Ala Cys Ala Cys Cys Thr Cys Ala Ala Gly
580 585 590
Thr Ala Cys Thr Gly Gly Cys Thr Ala Thr Ala Thr Thr Ala Thr Thr
595 600 605
Thr Gly Cys Ala Cys Cys Cys Ala Gly Thr Cys Cys Thr Gly Cys Ala
10 610 615 620
Gly Cys Gly Cys Cys Ala Gly Cys Ala Gly Cys Thr Gly Gly Ala Cys
625 630 635 640
Thr Ala Thr Gly Gly Cys Ala Thr Cys Thr Ala Thr Gly Thr Thr Ala
645 650 655
15Thr Cys Ala Ala Cys Cys Ala Gly Gly Cys Gly Gly Ala Gly Ala
660 665 670
Cys Ala Cys Thr Ala Thr Ala Thr Thr Cys Ala Ala Thr Cys Gly Thr
675 680 685
Gly Cys Thr Ala Ala Gly Cys Thr Cys Cys Thr Cys Ala Ala Thr Gly
20 690 695 700
25Thr Cys Thr Thr Gly Ala Ala Gly Gly Ala Cys Thr Ala Thr Gly Ala Cys
705 710 715 720
25Thr Ala Cys Ala Cys Cys Thr Gly Cys Thr Thr Thr Gly Thr Gly Thr
725 730 735
Thr Thr Ala Gly Thr Gly Ala Cys Gly Thr Gly Gly Ala Cys Cys Thr
740 745 750
Cys Ala Thr Thr Cys Cys Ala Ala Thr Gly Ala Ala Thr Gly Ala Thr
30 755 760 765
Cys Ala Thr Ala Ala Thr Gly Cys Gly Thr Ala Cys Ala Gly Gly Thr
770 775 780
Gly Thr Thr Thr Thr Cys Ala Cys Ala Gly Cys Cys Ala Cys Gly
785 790 795 800
35Gly Cys Ala Cys Ala Thr Thr Thr Cys Cys Gly Thr Thr Gly Cys Ala
805 810 815
Ala Thr Gly Gly Ala Thr Ala Ala Gly Thr Thr Gly Gly Ala Thr
820 825 830
40 Thr Cys Ala Gly Cys Cys Thr Ala Cys Cys Thr Thr Ala Thr Gly Thr
835 840 845
Thr Cys Ala Gly Thr Ala Thr Thr Thr Gly Gly Ala Gly Gly Thr
850 855 860

Gly Thr Cys Thr Cys Thr Gly Cys Thr Thr Cys Ala Ala Gly Thr Ala
865 870 875 880
Ala Ala Cys Ala Ala Cys Ala Gly Thr Thr Thr Cys Thr Ala Ala Cys
885 890 895
5Cys Ala Thr Cys Ala Ala Thr Gly Gly Ala Thr Thr Thr Cys Cys Thr
900 905 910
Ala Ala Thr Ala Ala Thr Thr Ala Thr Thr Gly Gly Gly Gly Cys Thr
915 920 925
Gly Gly Gly Ala Gly Gly Ala Gly Ala Ala Gly Ala Thr Gly Ala
10 930 935 940
Thr Gly Ala Cys Ala Thr Thr Thr Ala Ala Cys Ala Gly Ala
945 950 955 960
Thr Thr Ala Gly Thr Thr Thr Ala Gly Ala Gly Gly Cys Ala
965 970 975
15Thr Gly Thr Cys Thr Ala Thr Cys Thr Cys Gly Cys Cys Cys
980 985 990
Ala Ala Ala Thr Gly Cys Thr Gly Thr Gly Gly Thr Cys Gly Gly Gly
995 1000 1005
Ala Cys Gly Thr Gly Thr Cys Gly Cys Ala Thr Gly Ala Thr Cys Cys
20 1010 1015 1020
Gly Cys Cys Ala Cys Thr Cys Ala Ala Gly Ala Gly Ala Cys Ala Ala
1025 1030 1035 1040
Gly Ala Ala Ala Ala Ala Thr Gly Ala Ala Cys Cys Cys Ala Ala Thr
1045 1050 1055
25Cys Cys Thr Cys Ala Gly Ala Gly Gly Thr Thr Thr Gly Ala Cys Cys
1060 1065 1070
Gly Ala Ala Thr Thr Gly Cys Ala Cys Ala Cys Ala Ala Ala
1075 1080 1085
Gly Gly Ala Gly Ala Cys Ala Ala Thr Gly Cys Thr Cys Thr Cys Thr
30 1090 1095 1100
Gly Ala Thr Gly Gly Thr Thr Gly Ala Ala Cys Thr Cys Ala Cys
1105 1110 1115 1120
Thr Cys Ala Cys Cys Thr Ala Cys Cys Ala Gly Gly Thr Gly Cys Thr
1125 1130 1135
35Gly Gly Ala Thr Gly Thr Ala Cys Ala Gly Ala Gly Ala Thr Ala Cys
1140 1145 1150
Cys Cys Ala Thr Thr Gly Thr Ala Thr Ala Cys Cys Cys Ala Ala Ala
1155 1160 1165
Thr Cys Ala Cys Ala Gly Thr Gly Gly Ala Cys Ala Thr Cys Gly Gly
40 1170 1175 1180
Gly Ala Cys Ala Cys Cys Gly Ala Gly Cys Thr Ala Gly
1185 1190 1195

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<212> DNA
<213> Artificial Sequence

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<220>
<223> A synthetic primer

<400> 12
10atcgggaaga cgcgtcacat ccggccactcg agagac

36

<210> 13
<211> 36
<212> DNA
15<213> Artificial Sequence

<220>
<223> A synthetic primer

20<400> 13
atcgggaaga cgcgtgagat ccggccactcg agagac

36